EARTH OBSERVING SYSTEM
GEOSCIENCE LASER ALTIMETER SYSTEM

# GLAS Science Software Requirements Document

## Version 2.0

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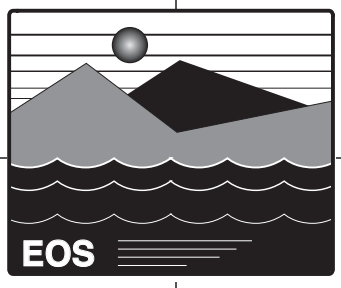

# Foreword

This document addresses the software requirements of the GLAS Standard Data Software (SDS) supporting the GLAS instrument on the EOS ICESat Spacecraft. The SDS encompasses major portions of both the ICESat Science Investigator-led Processing System (I-SIPS) Software and the Instrument Support Terminal (IST) Software. For the I-SIPS Software, the SDS will produce Level 0, Level 1A, Level 1B, and Level 2 data products as well as the associated product quality assessments. For the IST, the SDS software will accommodate the GLAS instrument support areas of engineering status, command, performance assessment, and instrument health status.

The GLAS Standard Data Software is being constructed within the framework and model presented by the NASA Software Documentation Standard, i.e., the Standard (NASA-STD-2100-91). An important tenet of the NASA Software Engineering Program is to record the essential information in the project documentation. This documentation provides the information necessary to support and sustain the development life cycle and the maintenance of the software system.

This Software Requirements Document represents the initial collection of the technical engineering information for the GLAS Standard Data Software. This information is detailed within the second of four main volumes of the Standard documentation, the Product Specification volume. This document is a “roll-out” from the governing volume outline containing the Concept and Requirements sections.

This GLAS Science Software Requirements Document has been prepared by the GLAS Standard Data Software Development Team, Observational Science Branch, Laboratory for Hydrospheric Processes, NASA Goddard Space Flight Center, Wallops Flight Facility, Wallops Island, Virginia. This document was prepared in support of Dr. Bob E. Schutz, GLAS Science Team Leader, for the GLAS Science Investigation. This work was performed under the direction of David W. Hancock, III, GLAS Standard Data Software Development Team Leader, who may be contacted at (757) 824-1238, hancock@osb1.wff.nasa.gov (e-mail), or (757) 824-1036 (Fax).

# Document Change History

| Document Name: GLAS Science Software Requirements Document | | |
|---|---|---|
| **Version Number** | **Date** | **Nature of Change** |
| **Preliminary** | **December 31, 1996** | **Original Version** |
| **Version 1.2** | **July 1998** | **Updated requirements. Updated with new terminology.** |
| **Version 2.0** | **September 30, 1998** | **Updated for change to ICESat Science Investigator-led Processing System.** |
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# Items to be Resolved

1) Obtain latest reference for instrument software requirements.

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# Preface

This document represents the first roll-out of the Product Specification for the GEOSCIENCE LASER ALTIMETER SYSTEM (GLAS) Standard Data Software (SDS). The software concept and requirements sections constitute the primary content of this document. This document will be configured and maintained as an informal[1] part of the GLAS Science Software Delivery Package. It is the prerequisite document to the GLAS SDS architectural design documents.

The GLAS Standard Data Software comprises the segments identified as the ICESat Science Investigator-led Processing System (I-SIPS) Software and the GLAS Instrument Support Terminal (IST) Software. The I-SIPS Software produces the Level 1 and the Level 2 data products and their metadata. The IST Software supports instrument operations and monitoring.

1.The Software Requirements Document is not specifically listed as a deliverable component of the stated ESDIS delivery package. It has been included as a part of the planned approach indicated in the GLAS Science Software Management Plan. It is therefore being identified as an informal rather than a formal (required) Project deliverable.

Section 1

# Introduction

## 1.1 Identification of Document

This is the Software Requirements Document of the GLAS Standard Data Software (SDS). This document contains the Concept and Requirements documentation for the Standard Product Specification Volume.

This software requirements document is the first document "rolled out" of the specification volume. This document is specified as a deliverable in the GLAS Standard Data Software Documentation Tree in the GLAS Science Software Management Plan. It is identified as the GLAS Science Software Requirements Document (GSSRD), document number GLAS-PRS-2100 in the document numbering scheme in compliance with the software management plan.

Successive editions of this document will be uniquely identified by the document version and date marks on the cover and individual page footers. For brevity this document will be referred to throughout the subsequent text as the GSSRD.

## 1.2 Scope of Document

This document encompasses the software project concepts and requirements imposed on the GLAS Standard Data Software by the EOS mission level and the GLAS Science Investigation. This document is produced as a responsibility of the GLAS Standard Data Software Development Team under the direction of the GLAS Science Team Leader.

This document is applicable to the GLAS Standard Data Software consisting of the ICESat Science Investigator-led Processing System (I-SIPS) Software and the GLAS Instrument Support Terminal (IST) Software.

## 1.3 Purpose and Objectives of Document

The purpose of the GLAS Science Software Requirements Document is to specify the requirements imposed on the GLAS Standard Data Software. This requirements specification document represents the initial document roll-out of the product specification volume under the NASA software engineering standards. The GSSRD conforms with the outline topics included in the concept and requirements templates in the NASA software engineering document.

The following objectives are identified for this requirements specification:

- The GSSRD is to represent a collection of those identified, definable, real requirements that have a governing impact or influence upon the development of the SDS.

- These requirements are traceable to either an external source such as an ESDIS Project document, or an internal source such as a GLAS Science Team or Instrument Team document.
- Wherever a newly defined requirement is introduced within this document, it will clearly be identified that it is a derived requirement within the GSSRD (i.e., not specified in or inherited from other sources), and a validation for the requirement will be supplied.
- This requirements specification will be an incremental, living document containing a baseline core of requirements. Subsequent issues will present newly identified and add-on requirements as they are determined.
- The final GSSRD will be a uniform, complete collection of requirements applicable to the GLAS SDS. While the document is intended to be incremental in its development, it is to be considered as the single-source list of requirements imposed on the software development effort. The requirements are to presented in a concise form with traceability to the source document or authority as the detailed description of the requirement.
- The GSSRD format and contents are based on the document templates in the NASA software engineering standards document. As such, it seeks to remain consistent with the organization and intended content of those sections to at least a top-level of detail. The conformity to this information format is a goal throughout the life cycle of this document.
- The GSSRD is the first product specification document roll-out. The GSSRD is a predecessor to the GLAS Science Software Architectural Design Specification. This document will be limited to the specification of requirements, and will avoid extension or encroachment into the design documentation segment of the design phase.
- The requirements collection is expanded with the inclusion of constraints that are imposed upon the development and implementation of the software system as well.

## 1.4 Document Status and Schedule

This requirements specification is Version 1.2 of the GLAS Science Software Requirements Document. Subsequent editions of the document will include any additional ESDIS Project, instrument, and investigation team requirements which are related to the Standard Data Software.

## 1.5 Document Organization

The organization of the GLAS Science Software Requirements Document is based on the Concept and Requirements sections of the Product Specification Volume under the NASA software engineering program documentation standards. The standards are obtained from the *NASA Software Documentation Standard Software Engineering Program* document [Reference 2.2a].

Sections 1 and 2 contain the introductory and reference document information for the GSSRD. Section 3 contributes the organization for the standard Concept section. It represents an abbreviated, condensed composition of the section template from the documentation standards. The concept section is effectively rolled up into this requirements specification as a portion of the document.

Section 4 contains the core and incremental collection of the software system requirements. It is subdivided into the primary subsections aligned to a presentation of the I-SIPS Software and the GLAS IST Software components.

The GSSRD appendices list the SDS requirements in one location and provide the traceability of the requirements to their source(s). The GSSRD appendices are then followed by the supplemental information contained in the abbreviations and acronyms and the glossary sections.

Any upper level section and sub-section headings from the document standards template that are not populated with information or are not germane to the scope of the GSSRD will be identified with a not-applicable tag (N/A). Any sections or sub-sections that are supplemental to the standard outline will be denoted as additions.

Section 2

# Related Documentation

This Section provides the bibliography and references for the GLAS Science Software Requirements Document. Document references include parent documents, applicable documents, and information documents.

## 2.1 Parent Documents

Parent documents are those external, higher-level documents that contribute information to the scope and content of the context and requirements details of the GSSRD. The following GLAS Team documents are parent to this requirements specification document.

a) *GLAS Science Software Management Plan* (GLAS SSMP), Version 2.2, July 1998, NASA Goddard Space Flight Center Wallops Flight Facility, GLAS-SMP-1100.

b) *GLAS Science Data Management Plan* (GLAS SDMP), Version 2.2, July 1998, NASA Goddard Space Flight Center Wallops Flight Facility, GLAS-DMP-1200.

The GLAS SSMP is the top-level Volume 1 (Management Plan Volume) document, dictating the creation and maintenance of the GSSRD as a part of the software system development life cycle. The GLAS SDMP represents the immediate predecessor document (also from the Management Plan Volume) and contains details contributing to the data product and interface requirements. Within the four-volume NASA software documentation standards [Reference 2.2c], the Product Specification Volume (Volume 2) follows the Management Volume. There is no overall GLAS Science Software Product Specification [Volume].

## 2.2 Applicable Documents

Applicable documents to the GSSRD include reference documents that are not parent documents. This category includes reference documents that have direct applicability to, or contain policies binding upon the content of this document. The following ESDIS Project, NASA, or other Agency documents are cited as applicable to this requirements specification document.

a) *NASA Software Documentation Standard Software Engineering Program*, NASA, July 29, 1991, NASA-STD-2100-91.

b) *Science User's Guide and Operations Procedure Handbook for the ECS Project, Volume 4: Software Developer's Guide to Preparation, Delivery, Integration and Test with ECS*, Final, August 1995, Hughes Information Technology Corporation, 205-CD-002-002.

c) *Data Production Software and Science Computing Facility (SCF) Standards and Guidelines*, January 14, 1994, Goddard Space Flight Center, 423-16-01.

d) *EOS Output Data Products, Processes, and Input Requirements*, Version 3.2, November 1995, Science Processing Support Office.

The following GLAS Science Team and Engineering Team documents are cited as applicable to this requirements specification document.

e) *NASA Earth Observing System Geoscience Laser Altimeter System GLAS Science Requirements Document,* Version 2.01, October 1997, Center for Space Research, University of Texas at Austin.

f) *Precision Orbit Determination (POD) Algorithm Theoretical Basis Document*, Version 0.1, December 1996, Center for Space Research of The University of Texas at Austin, GLAS TN 95-014.

g) *Atmospheric Delay Correction to GLAS Laser Altimeter Ranges Algorithm Theoretical Basis Document*, Version 0.3, December 1996, Massachusetts Institute of Technology, GLAS TN 95-011.

h) *Algorithm Theoretical Basis Document for the GLAS Atmospheric Channel Observations*, Version 0, December 1995, Goddard Space Flight Center, GLAS TN 95-012.

i) *Geoscience Laser Altimeter System: Surface Roughness of Ice Sheets,* Algorithm Theoretical Basis Document, Version 0.3, December 1996, University of Wisconsin.

j) *Determination of Sea Ice Surface Roughness from Laser Altimeter Waveform Algorithm Theoretical Basis Document*, Version 0, December 1995, The Ohio State University, GLAS TN 95-010.

k) *Laser Footprint Location and Surface Profiles*, Algorithm Theoretical Basis Document, Version 0 (Preliminary), December 1996, Center for Space Research, The University of Texas at Austin.

l) *Precision Attitude Determination (PAD)*, Algorithm Theoretical Basis Document, December 1996, Center for Space Research, The University of Texas at Austin.

## 2.3 Information Documents

Information documents are those that are not directly applicable as a reference to this requirements specification document. They are documents providing information that will serve to amplify or clarify concepts or requirements contained in the GSSRD. These information documents will be further identified as to their relationship to the GSSRD, and whether or not their information content is binding or nonbinding on this document.

The following ESDIS Project, NASA, or other Agency documents are cited as providing background or supplemental information to this requirements specification document.

a) *Operations Concept for Integration and Test of Science Data Production Software*, White Paper, March 1995, Hughes Applied Information Systems, Inc., 62-WP-

001-002.

b) *Interface Control Document Between EOSDIS Core System (ECS) and Science Computing Facilities (SCF)*, December 1995, Hughes Information Technology Corporation, 209-CD-005-504.

c) *SDP Toolkit Users Guide for the ECS Project*, August 1995, Hughes Information Technology Corporation, 333-CD-003-002.

Reference documents 2.3a, 2.3b, and 2.3c provide information concerning the Science Data Processing Toolkit and the Science Computing Facility. These documents are initially indicated to provide non-binding information to the GSSRD content.

Section 3

# Concept

The following subsections provide a brief overview of the GLAS Standard Data Software (SDS). The functional descriptions and definitions of GLAS SDS capabilities provide the context foundation for the traceable requirements presented in Section 4. For subsequent discussions, the GLAS SDS is subdivided into its functional components as presented in the following section.

## 3.1 Purpose and Scope

The purpose of the GLAS SDS is to produce the GLAS standard data products and their metadata (descriptive information) and to provide the capability to monitor and operate the GLAS instrument. The GLAS SDS is built under the direction of the GLAS Science Team with support from the Instrument Team. The GLAS SDS does not produce any GLAS supplemental or special data products.

## 3.2 Goals and Objectives

The following goals and objectives for the GLAS SDS are applicable to all software units regardless of function or scope.

The software units will be developed in accordance with a structured, life cycle development approach as identified in the GLAS Science Software Management Plan.

- Software units will be accompanied by required software system standard documentation.
- The software units will be planned and developed based on a realistic project management timeline. The units' development will recognize and will meet or exceed all Project and GLAS Team milestones for review and delivery.

## 3.3 Description

The GLAS SDS is subdivided into two major categories: the ICESat Science Investigator-led Processing System (I-SIPS) Software and the GLAS IST Software.

The I-SIPS Software constitutes those software units containing the GLAS science algorithms. These are programs that perform the work of transforming lower level data products into higher level data products. This body of software is specific to those data products identified as the GLAS Standard Data Products. In addition, the I-SIPS Software will support routine data quality assurance and assessment, and metadata production. These software units will be used to monitor the performance of the science data production software.

The major external interfaces of the I-SIPS Software include: the ICESat SCF, the GLAS Science Team, the I-SIPS Team, the Instrument Operations Team, and the

DAAC environment. The I-SIPS Software will utilize the ESDIS-provided SDP Toolkit to perform data product formatting and to interface to the DAAC.

The GLAS IST Software includes the software units that will reside on the GLAS Instrument Support Terminal nodes. These software units will provide instrument health assessment and monitoring, and provide command capabilities for the GLAS Instrument Team. The GLAS IST Software will be operated by the instrument and operations teams.

The GLAS IST Software will interface with the EOC, the GLAS IST environment, and the GLAS Instrument Operations Team. The IST Software will utilize the ESDIS-provided Instrument Support Toolkit.

Section 4

# Requirements

This section provides a collective repository for the requirements governing the GLAS Standard Data Software. This repository includes functional, performance, and interface requirements imposed on the key segments of GLAS SDS. The first subsection (4.1) describes the overall approach to determining the requirements and the results of trade-offs. Section 4.1 is applicable to both the I-SIPS and IST Software segments.

The requirements specification subsections (4.2 and 4.3) present the major characteristics for each of the software segments, along with goals pertaining to the design phase and associated constraints on the software implementation phase. Each presented requirement is uniquely identified with an assigned requirements number that will be used to point back to the parent or applicable document. Sufficient information is maintained in an external requirements data base to support traceability of requirements back to the originating document. The parent and applicable document external requirements and traceability information are presented in Appendices A and B respectively. The traceability information is intended to ensure that the source for each requirement and the requirement's location in that document are known.

## 4.1 Requirements Approach and Trade-offs

The overall requirements approach is a basic collection process followed by incremental growth rings. The basic collection process involves identifying and gathering a baseline requirements set. The baseline set contains requirements obtained from parent and applicable document sources. In the Project hierarchy, the contributions are obtained from the GLAS Science Team, the GLAS Instrument Team, and the ESDIS Project. Documents relevant to ESDIS, the EOSDIS Distributed Active Archive Center (DAAC), the Flight Operations Segment (FOS), and the Project-provided Toolkits provide the inherited Project-level requirements details. These are the initial requirements imposed on the I-SIPS Software and the IST Software.

The mission requirements document, the software management plan, the data management plan, the algorithm theoretical basis documents, and the instrument and standard data product specifications form the core of the science investigation and engineering requirements placed on the software. This requirements information gathering process is a very broad but non-discriminating function. If the information looks like a requirement, it is incorporated into the collection. The second step of the approach is where discrimination is applied. This filtering process constitutes the analysis step of the requirements approach.

Requirements that are derivatives of the original requirements, either by deduction or by analysis of additional information, are called derived requirements. These requirements are clearly identified and are referenced back to their source(s). Derived

requirements may be determined throughout the software life cycle as a result of the design activities and prototyping.

Requirements are identified by a requirement number. The requirement number contains a text string that identifies the allocation of the requirement to a category. The text portion of the string can be:

- GSDS - refers to GLAS Standard Data Software requirements. These requirements are applicable to both subsystems or may be fulfilled by either subsystem. These requirements also include those imposed on the management of the software development or the software development process itself.
- GSDP - refers to GLAS Standard Data Product generation software requirements. These requirements are fulfilled by the I-SIPS Software.
- GISS - refers to the GLAS Instrument Support Software requirements. These requirements are fulfilled by the GLAS IST Software.

The remaining portion of the identifier is a numeric field which uniquely identifies each requirement. The numeric portion of the requirement number allows sufficient digits for the inclusion of derived requirements. The first digit indicates the category of the requirement: 0, 1, 2 - GSDS; 3, 4, 5 - GSDP; 6, 7, 8 - GISS; and 9 - spare. The next 2 digits are allocated to original requirement numbers; the last 2 digits to their derived requirement numbers. For example, for an original requirement number GSDP-30100, the number of the first requirement derived from it will be GSDP-30101.

It is incumbent on the Science Team Leader and the Standard Data Software Development Team Leader to quickly identify and respond to prioritization of competing requirements. As a guideline, GLAS Science and Instrument Requirements are to be initially accommodated prior to a Project level requirement. It is assumed that Project elements will independently report any failure of the GLAS science software to comply with Project-level requirements.

Requirements to be considered for modification, exclusion, or addition must be addressed through the engineering change proposal process according to the software management plan. This process entails analysis by the software development team in concert with the change control authority at the science team level. The assessment must include information as to the degree of impact of the modification within the maturity level of the design or implementation.

## 4.2 Standard Data Software Requirements

### 4.2.1 External Interface Requirements

The external interface requirements are the requirements for the interfaces between the SDS and its external users. Users include humans and software. Additional external interface requirements are defined with respect to the I-SIPS Software and the IST Software; see Sections 4.3.1 and 4.4.1.

GSDS-01400 The Standard Data Software will interface with the Science Team, I-SIPS Team, Instrument Operations Team, the EOC, the EOSDIS

DAAC, the GLAS IST, and the GLAS SCF. The Standard Data Software will interface with the standard data products, ancillary input data, and files supporting instrument operations.

### 4.2.2 Process and Data Requirements

The requirements in this subsection represent the process and data requirements imposed on the SDS. These include functional requirements placed on the software processes based on the input data and its source, the output data and its destination, and the data transformations, transactions, and algorithms to be performed on the data. Additional process and data requirements are defined with respect to the I-SIPS Software and the IST Software; see Sections 4.3.2 and 4.4.2.

GSDS-00200 Requisite GLAS data and ancillary data files must be available prior to the generation of a standard data product as specified by the GLAS Data Management Plan.

GSDS-00600 The Standard Data Software will provide instrument health and performance trend data.

### 4.2.3 Performance and Quality Engineering Requirements

The requirements in this subsection represent the performance and quality engineering requirements imposed on the SDS. This section defines requirements relating to the performance of the software and error recovery. Quality engineering requirements address the aspects particular to software reliability, maintainability, and portability. Testing requirements are defined in this section. Additional performance and quality engineering requirements are defined with respect to the I-SIPS Software and the IST Software; see Sections 4.3.3 and 4.4.3.

GSDS-00300 A test data set shall be developed to be included in the software delivery packages.

GSDS-00400 At a minimum, integration tested deliveries shall be completed for each Project milestones version delivery.

GSDS-00500 Acceptance testing and reporting shall be performed on each version delivery.

GSDS-00700 As a minimum, the following reviews are required: Requirements/ Architectural Design Review, Detailed Design Review, Acceptance Review, and Operations Readiness Reviews.

GSDS-00800 A record log shall be maintained for the configuration status of both the GLAS Standard Data Software and its documentation.

GSDS-01500 Throughout its development the Standard Data Software shall be subjected to informal and formal reviews and walkthroughs.

### 4.2.4 Safety Requirements

Each requirement in this subsection represents the safety requirements imposed on the SDS. These will include a prioritized list of requirements pertaining to software

hazards and their contribution to host system mishaps and user interface operations. The impact of software tasks, their criticality to segment operations, flow of processing information, and operation by the operational personnel should be specified. Any similar specifications impacting software maintenance functions are part of this topic as well. The safety requirements are defined with respect to the I-SIPS Software and the IST Software; see Sections 4.3.4 and 4.4.4.

*none specific to Standard Data Software to date*

### 4.2.5 Security and Privacy Requirements

Each requirement in this subsection represents the security and privacy requirements imposed on the SDS. These requirements should include access limitation considerations to the host system and the software segment, and data protection and recovery method specifications. Additional security and privacy requirements are defined with respect to the I-SIPS Software and the IST Software; see Sections 4.3.5 and 4.4.5.

GSDS-00100 The GLAS Standard Data Software baselined code products and documentation will be stored in designated controlled directory and file space to ensure the maintenance of product integrity.

GSDS-00900 The Standard Data Software product integrity must be ensured throughout the software development and the operational mission.

GSDS-01000 Access, userids, passwords, and directory space information will be protected. All operations will be performed in accordance with GSFC and ESDIS security guidelines and requirements.

### 4.2.6 Implementation Constraints

This subsection presents the constraints imposed on the SDS implementation. These conditions include implementation considerations that impact the design phase for the software segments such as use of certain GFE, COTS, languages, compilers, assemblers, libraries, and architecture. Directions to use existing software or to perform modification of software are contained within this constraint grouping. Any engineering or technical standards applicable or imposed on the design and implementation should be specified here as well. Additional implementation constraints are defined with respect to the I-SIPS Software and the IST Software; see Sections 4.3.6 and 4.4.6.

GSDS-01200 All software development for the GLAS Standard Data Software shall follow a well-defined software life cycle plan with adequate documentation generated and reviews held. The approach taken shall follow the guidelines of the NASA Software Engineering Program (NSEP), to define and document requirements thoroughly before beginning design, and to use prototyping to refine requirements, verify critical areas of the design, and mitigate any higher risk elements.

GSDS-01300 The Engineering Change Proposal process shall be able to accommodate problem reports or change requests submitted by people outside of the Standard Data Software Development Team.

GSDS-01100 The GLAS Standard Data Software Development Team will create and adhere to a set of programming standards and guidelines.

GSDS-01600 The Standard Data Software shall adhere to ESDIS requirements when interfacing to the Project facilities to deliver or retrieve files.

### 4.2.7 Site Adaptation

Site adaptation requirements are those imposed on the SDS segments to adapt it to the physical environment in which it will operate. These requirements are generally host-site specific and should include any parameters due to installation phase definitions or conditions. Site adaptation requirements are defined with respect to the I-SIPS Software and the IST Software; see Sections 4.3.7 and 4.4.7.

*none specific to Standard Data Software to date*

### 4.2.8 Design Goals

This subsection contains the design goals of the software segments. Categories within include correctness, reliability, efficiency, and maintainability of the implemented software. The Standard Data Software design goals are:

GSDS-01700 The design of the Standard Data Software shall provide for 100% fulfillment of the stated and defined requirements.

GSDS-01800 To adequately define and document the requirements and the design of the SDS so that a programmer unfamiliar with the software can easily maintain or modify it.

GSDS-01900 By following a well-defined life cycle for software development, implement software that is highly reliable and maintainable.

Additional design goals are defined with respect to the I-SIPS Software and the IST Software; see Sections 4.3.8 and 4.4.8.

## 4.3 I-SIPS Software Requirements

### 4.3.1 External Interface Requirements

This section defines the external interface requirements on the I-SIPS Software. These interfaces include the GLAS Science Team, the I-SIPS Team, the GLAS SCF, and the EOSDIS DAAC. The background reference for these interfaces is found in the Science Software Management Plan (reference document 2.1a).

The following requirements are identified as applicable to I-SIPS Software external interface management.

GSDP-30100 The I-SIPS Software will create GLAS standard products that are to be delivered to the DAAC in the format agreed to by ESDIS.

GSDP-30300 The EDOS collected Level 0 data will be provided from the EOSDIS DAAC to the I-SIPS.

GSDP-30400 The I-SIPS Team shall ensure the availability and integrity of the ancillary data files necessary to produce the GLAS standard data products.

GSDP-31000 The I-SIPS Software shall accept as input: the GLAS instrument packet data, the GLAS standard data products and ancillary data.

### 4.3.2 Process and Data Requirements

GSDP-30200 The I-SIPS Software shall create the GLAS standard data products, at appropriate data rates and with sufficient precision, to satisfy the requirements of the Science Team and users.

GSDP-30600 The I-SIPS Software will create the GLAS Level 1A data from the Level 0 GLAS instrument data products.

GSDP-30700 The I-SIPS Software will create the GLAS Level 1B data from GLAS Level 1A or 1B data and ancillary data.

GSDP-30800 The I-SIPS Software will create the GLAS Level 2 data from the Level 1B or Level 2 data and ancillary data.

GSDP-30900 Metadata will include an assessment of the software performance.

GSDP-31100 The I-SIPS Software shall produce metadata describing the data products and their quality.

GSDP-31200 The I-SIPS Software shall properly implement the science algorithms as specified in the Algorithm Theoretical Basis Documents.

GSDP-31300 Automatic or manual Quality Assurance (QA) is provided for each standard data product and ancillary file. Until QA is completed, the file shall be marked as unvalidated. Upon successful completion of QA, the file shall be marked as validated.

GSDP-31400 Fixed metadata (which includes the mission description and high-level data product description) will be delivered to the ESDIS as part of the software delivery package and will be updated as necessary.

### 4.3.3 Performance and Quality Engineering Requirements

GSDP-31500 The I-SIPS Software will be implemented such that it will require minimal modifications in order to port the software to another hardware system.

GSDP-31800 The I-SIPS Software shall incorporate sufficient data and process error handling for error detection, isolation, and recovery.

GSDP-31900 The implemented I-SIPS Software shall be reliable.

GSDP-32000 The implemented I-SIPS Software shall be maintainable.

### 4.3.4 Safety Requirements

*none specific to I-SIPS Software to date*

### 4.3.5 Security and Privacy Requirements

*none specific to I-SIPS Software to date*

### 4.3.6 Implementation Constraints

*none specific to I-SIPS Software to date*

### 4.3.7 Site Adaptation

*none specific to I-SIPS Software to date*

### 4.3.8 Design Goals

The Standard Data Software design goals are:

GSDP-31600 During nominal operations, the implemented I-SIPS Software should be able to process 24 hours of GLAS instrument data into the GLAS standard data products in 4 hours.

GSDP-31700 The data contained in the GLAS standard data products will not be geolocated until the precision orbit data is available.

GSDP-32200 Due to input data updates or processing software changes, the I-SIPS Software shall be capable of reprocessing entire or selected parameters on GLAS standard data product(s).

## 4.4 GLAS Instrument Support Terminal Software Requirements

### 4.4.1 External Interface Requirements

The external interfaces to the IST Software include the EOS Operations Center (EOC), the IST, the GLAS Science and Instrument Teams, and the Instrument Operations Team. The following external interfaces requirements are identified.

GISS-60100 The instrument health assessment software will produce routine reports and graphical displays for the GLAS Science and Instrument Operations Teams to review and evaluate.

GISS-60200 The IST software shall interface with the EOS Operations Center to provide instrument command and monitoring capabilities.

GISS-60300 The Instrument Support Terminal will accept EDOS-collected housekeeping and engineering data from the EOC.

GISS-60700 The Instrument Support Terminal will accept EDOS-collected Level 0 instrument data from the EOSDIS DAAC.

### 4.4.2 Process and Data Requirements

GISS-60400 The instrument command software will support the preparation of laser altimeter operational command sequences and the validation of these command sequences.

GISS-60500 The IST Software will support the GLAS Flight Software reprogramming or parameter changes.

GISS-60600 The instrument health assessment software will evaluate data received from both the EOS ICESat spacecraft and the GLAS instrument to determine the health and welfare of the laser and electronics.

### 4.4.3 Performance and Quality Engineering Requirements

GISS-60800 IST Software shall be developed to be reliable, maintainable, portable, and shall incorporate sufficient data and process error handling for error detection, isolation, and recovery.

### 4.4.4 Safety Requirements

GISS-60900 The instrument command software will ensure that unauthorized or erroneous commands are not created and sent to the instrument.

GISS-61000 The instrument health assessment software will report data that exceed engineering threshold or limits values, and will raise flags identifying anomalous or erroneous instrument activity which may indicate aberrant sensor behavior or mission-threatening conditions.

### 4.4.5 Security and Privacy Requirements

GISS-61300 The IST shall be operated in a secure manner to prevent unauthorized use.

### 4.4.6 Implementation Constraints

GISS-61100 The IST software shall be designed and developed to utilize the mandatory functions of the ESDIS-supplied Instrument Support Toolkit.

### 4.4.7 Site Adaptation

*none specific to IST Software to date*

### 4.4.8 Design Goals

*none specific to IST Software to date*

## 4.5 Traceability to Parent's Design

The requirements are obtained or directly derived from the contents of parent or applicable documentation (called the source). Requirements are parsed or allocated

into the appropriate category or subsection based on the text of the requirement and the context in the source(s) from which it is obtained. The maintenance of all SDS requirements and associated descriptions and source document identification information is essential in providing traceability throughout the software development process. The tracking information that maps requirements to their source(s) is stored in the requirements data base; this provides the capability to track the requirements through the design and implementation phases. The tracking information (from the requirements data base) is included in Appendix B in tabular form, to provide the traceability of the requirements to their source(s). In Appendix B, the traceability is shown by listing the requirements' section number (i.e., location of the requirement in this document), requirement number (as listed in this document), the source document number and the source document section.

## 4.6 Partitioning for Phased Delivery

Several deliveries are planned for the SDS, based on the spacecraft launch schedule and the investigation statement of work. Requirements to be implemented in each of the deliveries of the SDS will be identified in the design documentation. For each delivery, the constituent software unit set is to be clearly identified and specified.

Per the statement of work, the I-SIPS Software will be delivered at three delivery milestones: Beta (V0), Version 1 (V1), and Version 2 (V2). Pre-launch activities and post-launch acceptance and verification testing may necessitate additional final and on-orbit package deliveries as well.

The IST Software will be delivered in up to 3 deliveries. These deliveries do not correspond to the I-SIPS Software deliveries. The IST Software design documentation will define the software deliveries in more detail.

# Appendix A
# Requirements

This appendix represents a complete listing of the requirements presented in this document.

**Table A-1 Software Requirements Matrix**

| Requirement Number | Description | Status |
|---|---|---|
| GSDS-00100 | The GLAS Standard Data Software baselined code products and documentation will be stored in designated controlled directory and file space to ensure the maintenance of product integrity. | original |
| GSDS-00200 | Some data products and requisite ancillary data files must be available prior to the generation of a standard data product as specified by the GLAS Data Management Plan. | original |
| GSDS-00300 | A test data set shall be developed to be included in the software delivery packages. | original |
| GSDS-00500 | Acceptance testing and reporting shall be performed on each version delivery. | original |
| GSDS-00600 | The Standard Data Software will provide instrument health and performance trend data. | original |
| GSDS-00700 | As a minimum, the following reviews are required: Requirements/Architectural Design Review, Detailed Design Review, Acceptance Review, and Operations Readiness Reviews. | original |
| GSDS-00800 | A record log shall be maintained for the configuration status of both the GLAS Standard Data Software and its documentation. | original |
| GSDS-00900 | The Standard Data Software product integrity must be ensured throughout the software development and the operational mission. | original |
| GSDS-01000 | Access, userids, passwords, and directory space information will be protected. All operations will be performed in accordance with GSFC and ESDIS security guidelines and requirements. | original |
| GSDS-01100 | The GLAS Standard Data Software Development Team will create and adhere to a set of programming standards and guidelines. | original |

**Table A-1 Software Requirements Matrix (Continued)**

| Requirement Number | Description | Status |
|---|---|---|
| GSDS-01200 | All software development for the GLAS Standard Data Software shall follow a well-defined software life cycle plan with adequate documentation generated and reviews held. The approach taken shall follow the guidelines of the NASA Software Engineering Program (NSEP), to define and document requirements thoroughly before beginning design, and to use prototyping to refine requirements, verify critical areas of the design, and mitigate any higher risk elements. | original |
| GSDS-01300 | The Engineering Change Proposal process shall be able to accommodate problem reports or change requests submitted by people outside of the Standard Data Software Development Team. | original |
| GSDS-01400 | The Standard Data Software will interface with the Science Team, I-SIPS Team, Instrument Operations Team, the EOC, the EOSDIS DAAC, the GLAS IST, and the GLAS SCF. The Standard Data Software will interface with the standard data products, ancillary input data, and files supporting instrument operations. | original |
| GSDS-01500 | Throughout its development the Standard Data Software shall be subjected to informal and formal reviews and walkthroughs. | original |
| GSDS-01600 | The Standard Data Software shall adhere to ESDIS requirements when interfacing to the Project facilities to deliver or retrieve files. | original |
| GSDP-00100 | The I-SIPS Software will create GLAS standard products that are to be delivered to the DAAC in the format agreed to by ESDIS. | original |
| GSDP-00200 | The I-SIPS Software shall create the GLAS standard data products, at appropriate data rates and with sufficient precision, to satisfy the requirements of the Science Team and users. | original |
| GSDP-00300 | The EDOS collected Level 0 data will be provided from the EOSDIS DAAC to the I-SIPS. | original |
| GSDP-00400 | The I-SIPS Team shall ensure the availability and integrity of the ancillary data files necessary to produce the GLAS standard data products. | original |
| GSDP-00600 | The I-SIPS Software will create the Level 1A GLAS standard data products from the Level 0 GLAS instrument data products. | original |

**Table A-1 Software Requirements Matrix (Continued)**

| Requirement Number | Description | Status |
|---|---|---|
| GSDP-00700 | The I-SIPS Software will create the Level 1B GLAS standard data products from Level 1A or 1B GLAS standard products and ancillary data. | original |
| GSDP-00800 | The I-SIPS Software will create the Level 2 GLAS standard data products from the Level 1B or Level 2 standard data products and ancillary data. | original |
| GSDP-00900 | Metadata will include an assessment of the software performance. | original |
| GSDP-01000 | The I-SIPS Software shall accept as input: the GLAS instrument packet data, the GLAS standard data products and ancillary data. | original |
| GSDP-01100 | The I-SIPS Software shall produce metadata describing the data products and their quality. | original |
| GSDP-01200 | The I-SIPS Software shall properly implement the science algorithms as specified in the Algorithm Theoretical Basis Documents. | original |
| GSDP-01300 | Automatic or manual Quality Assurance (QA) is provided for each standard data product and ancillary file. Until QA is completed, the file shall be marked as unvalidated. Upon successful completion of QA, the file shall be marked as validated. | original |
| GSDP-01400 | Fixed metadata (includes the mission description and high-level data product description) will be delivered to the ESDIS as part of the software delivery package and will be updated as necessary. | original |
| GSDP-01500 | The I-SIPS Software will be implemented such that it will require minimal modifications in order to port the software to another hardware system. | original |
| GSDP-01800 | The I-SIPS Software shall incorporate sufficient data and process error handling for error detection, isolation, and recovery. | original |
| GSDP-01900 | The implemented I-SIPS Software shall be reliable. | original |
| GSDP-02000 | The I-SIPS Software shall be implemented so that programmers who did not develop the software can maintain it. | original |
| GSDP-02100 | At a minimum, integration tested deliveries shall be completed for each Project milestones version delivery of the I-SIPS Software. | original |

**Table A-1 Software Requirements Matrix (Continued)**

| Requirement Number | Description | Status |
|---|---|---|
| GISS-00100 | The instrument health assessment software will produce routine reports and graphical displays for the GLAS Science and Instrument Operations Teams to review and evaluate. | original |
| GISS-00200 | The IST software shall interface with the EOS Operations Center to provide instrument command and monitoring capabilities. | original |
| GISS-00300 | The Instrument Support Terminal will accept EDOS-collected housekeeping and engineering data from the EOC. | original |
| GISS-00400 | The instrument command software will support the preparation of laser altimeter operational command sequences and the validation of these command sequences. | original |
| GISS-00500 | The IST Software will support the GLAS Flight Software reprogramming or parameter changes. | original |
| GISS-00600 | The instrument health assessment software will evaluate data received from both the EOS ICESat spacecraft and the GLAS instrument to determine the health and welfare of the laser and electronics. | original |
| GISS-00700 | The Instrument Support Terminal will accept EDOS-collected Level 0 instrument data from the EOSDIS DAAC. | original |
| GISS-00800 | IST Software shall be developed to be reliable, maintainable, portable, and shall incorporate sufficient data and process error handling for error detection, isolation, and recovery. | original |
| GISS-00900 | The instrument command software will ensure that unauthorized or erroneous commands are not created and sent to the instrument. | original |
| GISS-01000 | The instrument health assessment software will report data that exceed engineering threshold or limits values, and will raise flags identifying anomalous or erroneous instrument activity which may indicate aberrant sensor behavior or mission-threatening conditions. | original |
| GISS-01100 | The IST software shall be designed and developed to utilize the mandatory functions of the ESDIS-supplied Instrument Support Toolkit. | original |
| GISS-01300 | The IST shall be operated in a secure manner to prevent unauthorized use. | original |

# Appendix B
# Requirements Traceability Matrix

This Appendix provides a trace of the requirements listed in this document to their sources.

Table B-1 "Requirements Traceability Matrix" is organized with the following information:

- Requirements Document Section indicates the section number within this document containing the requirement.
- Requirement Number indicates the requirement number associated with the requirement in text of this document.
- Source Document Number indicates the document number or unique identifier for the original requirement. Table B-2 "Source Documents" lists the source document number with the source document name.
- Source Document Section indicates the section number containing the requirement within the parent or applicable document.

**Table B-1 Requirements Traceability Matrix**

| Requirements Document Section | Requirement Number | Source Document Number | Source Document Section |
|---|---|---|---|
| 4.2.5 | GSDS-00100 | GLAS-SMP-1100 | 10.2.2.1 |
| 4.2.2 | GSDS-00200 | GLAS-DMP-1200 | 4.0 |
| 4.2.3 | GSDS-00300 | GLAS-SMP-1100<br>GLAS-SMP-1100 | 4.2.1.3.2<br>4.2.1.2.2 |
| 4.2.3 | GSDS-00500 | GLAS-SMP-1100<br>GLAS-SMP-1100 | 4.2.1.2.3<br>4.2.1.3.3 |
| 4.2.2 | GSDS-00600 | GLAS-SMP-1100 | 3.0 |
| 4.2.3 | GSDS-00700 | GLAS-SMP-1100 | 6.3 |
| 4.2.3 | GSDS-00800 | GLAS-SMP-1100 | 10.2.3 |
| 4.2.5 | GSDS-00900 | GLAS-SMP-1100 | 10.2.2.1 |
| 4.2.5 | GSDS-01000 | GLAS-SMP-1100 | 10.2.2.1 |
| 4.2.3 | GSDS-01100 | GLAS-SMP-1100 | 6.1.1 |
| 4.2.6 | GSDS-01200 | GLAS-SMP-1100 | 6.1.1 |
| 4.2.6 | GSDS-01300 | GLAS-SMP-1100 | 6.1.3 |

**Table B-1 Requirements Traceability Matrix (Continued)**

| Requirements Document Section | Requirement Number | Source Document Number | Source Document Section |
|---|---|---|---|
| 4.2.1 | GSDS-01400 | GLAS-SMP-1100 | 6.4.1 |
| 4.2.6 | GSDS-01500 | GLAS-SMP-1100<br>GLAS-SMP-1100<br>GLAS-SMP-1100 | 8.2<br>8.1<br>4.2.1.2.3 |
| 4.2.6 | GSDS-01600 | GLAS-SMP-1100 | 5.4.1 |
| 4.3.1 | GSDP-00100 | GLAS-SMP-1100 | 3.1 |
| 4.3.2 | GSDP-00200 | GLAS-SMP-1100 | 3.1 |
| 4.3.1 | GSDP-00300 | GLAS-SMP-1100 | 3.1 |
| 4.3.1 | GSDP-00400 | GLAS-DMP-1200 | 5 |
| 4.3.2 | GSDP-00600 | GLAS-DMP-1200 | 4.1 |
| 4.3.2 | GSDP-00700 | GLAS-DMP-1200<br>GLAS-DMP-1200 | 4.2<br>4.3 |
| 4.3.2 | GSDP-00800 | GLAS-DMP-1200<br>GLAS-DMP-1200<br>GLAS-DMP-1200<br>GLAS-DMP-1200<br>GLAS-DMP-1200 | 4.4<br>4.9<br>4.6<br>4.5<br>4.7 |
| 4.3.2 | GSDP-00900 | GLAS-SMP-1100 | 3.1 |
| 4.3.1 | GSDP-01000 | GLAS-SMP-1100 | 3.1 |
| 4.3.2 | GSDP-01100 | GLAS-SMP-1100 | 3.1 |
| 4.3.2 | GSDP-01200 | GLAS-SMP-1100 | 4.2.1.2.2 |
| 4.3.2 | GSDP-01300 | GLAS-DMP-1200 | 3.5 |
| 4.3.2 | GSDP-01400 | GLAS-SMP-1100 | 4.2.1.2.3 |
| 4.3.3 | GSDP-01500 | GLAS-SMP-1100<br>GLAS-SMP-1100 | 6.1.1<br>5.4.1 |
| 4.3.3 | GSDP-01800 | GLAS-SMP-1100 | 6.1.1 |
| 4.3.3 | GSDP-01900 | GLAS-SMP-1100 | 6.1.1 |
| 4.3.3 | GSDP-02000 | GLAS-SMP-1100 | 6.1.1 |
| 4.2.3 | GSDP-02100 | GLAS-SMP-1100 | 4.2.1.2.2 |
| 4.4.1 | GISS-00100 | GLAS-SMP-1100 | 3.2 |
| 4.4.1 | GISS-00200 | GLAS-SMP-1100 | 3.2 |
| 4.4.1 | GISS-00300 | GLAS-DMP-1200 | 3.2.1 |

**Table B-1 Requirements Traceability Matrix (Continued)**

| Requirements Document Section | Requirement Number | Source Document Number | Source Document Section |
|---|---|---|---|
| 4.4.2 | GISS-00400 | GLAS-SMP-1100 | 3.2 |
| 4.4.2 | GISS-00500 | GLAS-SMP-1100 | 3.2 |
| 4.4.2 | GISS-00600 | GLAS-SMP-1100 | 3.2 |
| 4.4.1 | GISS-00700 | GLAS-DMP-1200 | 3.2.2 |
| 4.4.3 | GISS-00800 | GLAS-SMP-1100 | 6.1.1 |
| 4.4.4 | GISS-00900 | GLAS-SMP-1100 | 3.2 |
| 4.4.4 | GISS-01000 | GLAS-SMP-1100 | 3.2 |
| 4.4.6 | GISS-01100 | GLAS-SMP-1100 | 5.4.1 |
| 4.4.5 | GISS-01300 | GLAS-SMP-1100 | 4.3.4.2 |

**Table B-2 Source Documents**

| Document Number | Document Name |
|---|---|
| GLAS-SMP-1100 | GLAS Science Software Management Plan |
| GLAS-DMP-1200 | GLAS Science Data Management Plan |

# Abbreviations and Acronyms

| | |
|---|---|
| DAAC | Distributed Active Archive Center |
| ECP | Engineering Change Proposal |
| ECS | EOSDIS Core System |
| EDOS | EOS Data and Operations System |
| EOC | EOS Operating Center |
| EOS | NASA Earth Observing System Mission Program |
| EOSDIS | Earth Observing System Data and Information System |
| ESDIS | Earth Science Data and Information System |
| GIST | GLAS IST Software requirement |
| GLAS | Geoscience Laser Altimeter System instrument or investigation |
| GPS | Global Positioning System |
| GSDS | GLAS Standard Data Software |
| GSFC | NASA Goddard Space Flight Center |
| GSFC/WFF | NASA Goddard Space Flight Center/Wallops Flight Facility |
| GSSRD | GLAS Science Software Requirements Document |
| ICESat | Ice, Clouds and land Elevation Satellite |
| I-SIPS | ICESat Science Investigator-led Processing Systems |
| ISS | I-SIPS Software |
| IST | GLAS Instrument Support Terminal Facility and workstation(s) |
| LASER | Light Amplification by Stimulated Emission of Radiation |
| LIDAR | Light Detection and Ranging |
| N/A | Not (/) Applicable |
| NASA | National Aeronautics and Space Administration |
| NOAA | National Oceanic and Atmospheric Administration |
| POD | Precision Orbit Determination |
| SCF | GLAS investigation Science Computing Facility |
| SDPS | ECS Science Data Processing Segment |
| SDS | Standard Data Software |

| | |
|---|---|
| SDT | SDS Development Team |
| SDMP | GLAS Science Data Management Plan |
| SSMP | GLAS Science Software Management Plan |
| TBD | to be determined, to be done, or to be developed |
| UNIX | the operating system jointly developed by AT&T Bell Laboratories and the University of California-Berkeley System Division |

# Glossary

| | |
|---|---|
| aggregate | A collection, assemblage, or grouping of distinct data parts to make a whole. It is generally used to indicate the grouping of GLAS data items, arrays, elements, and EOS parameters into a data record. For example, the collection of Level 1B EOS Data Parameters gathered to form a one-second Level 1B data record. It could be used to represent groupings of various GLAS data entities such as data items aggregated as an array, data items and arrays aggregated into a GLAS Data Element, GLAS Data Elements aggregated as an EOS Data Parameter, or EOS Data Parameters aggregated into a Data Product record. |
| array | An ordered arrangement of homogenous data items that may either be synchronous or asynchronous. An array of data items usually implies the ability to access individual data items or members of the array by an index. An array of GLAS data items might represent the three coordinates of a georeference location, a collection of values at a rate, or a collection of values describing an altimeter waveform. |
| file | A collection of data stored as records and terminated by a physical or logical end-of-file (EOF) marker. The term usually applies to the collection within a storage device or storage media such as a disk file or a tape file. Loosely employed, it is used to indicate a collection of GLAS data records without a standard label. For the Level 1A Data Product, the file would constitute the collection of one-second Level 1A data records generated in the SDPS working storage for a single pass. |
| header | A text and/or binary label or information record, record set, or block, prefacing a data record, record set, or a file. A header usually contains identifying or descriptive information, and may sometimes be embedded within a record rather than attached as a prefix. |
| item | Specifically, a data item. A discrete, non-decomposable unit of data, usually a single word or value in a data record, or a single value from a data array. The representation of a single GLAS data value within a data array or a GLAS Data Element. |
| label | The text and/or binary information records, record set, block, header, or headers prefacing a data file or linked to a data file sufficient to form a labeled data product. A standard label may imply a standard data product. A label may consist of a single header as well as multiple headers and markers depending on the defining authority. |
| Level 0 | The level designation applied to an EOS data product that consists of raw instrument data, recorded at the original resolution, in time order, with any duplicate or redundant data packets removed. |
| Level 1A | The level designation applied to an EOS data product that consists of reconstructed, unprocessed Level 0 instrument data, recorded at the full resolution with time-referenced data records, in time order. The data are annotated with ancillary information including radiometric and geometric calibration coefficients, and georeferencing parameter data (i.e., ephemeris data). The included, computed coefficients and parameter data have not, however, been applied to correct the Level 0 instrument data contents. |

| | |
|---|---|
| Level 1B | The level designation applied to an EOS data product that consists of Level 1A data that have been radiometrically corrected, processed from raw data into sensor data units, and have been geolocated according to applied georeferencing data. |
| Level 2 | The level designation applied to an EOS data product that consists of derived geophysical data values, recorded at the same resolution, time order, and georeference location as the Level 1A or Level 1B data. |
| Level 3 | The level designation applied to an EOS data product that consists of geophysical data values derived from Level 1 or Level 2 data, recorded at a temporally or spatially resampled resolution. |
| Level 4 | The level designation applied to an EOS data product that consists of data from modeled output or resultant analysis of lower level data that are not directly derived by the GLAS instrument and supplemental sensors. |
| metadata | The textual information supplied as supplemental, descriptive information to a data product. It may consist of fixed or variable length records of ASCII data describing files, records, parameters, elements, items, formats, etc., that may serve as catalog, data base, keyword/value, header, or label data. This data may be parsable and searchable by some tool or utility program. |
| orbit revolution | The passage of time and spacecraft travel signifying a complete journey around a celestial or terrestrial body. For GLAS and the EOS LASER ALT spacecraft each orbit revolution starts at the time when the spacecraft is on the equator traveling toward the North Pole, continues through the equator crossing as the spacecraft ground track moves toward the South Pole, and terminates when the spacecraft has reached the equator moving northward from the South Polar region. |
| parameter | Specifically, an EOS Data Parameter. This is a defining, controlling, or constraining data unit associated with a EOS science community approved algorithm. It is identified by an EOS Parameter Number and Parameter Name. An EOS Data Parameter within the GLAS Data Product is composed of one or more GLAS Data Elements |
| pass | A sub-segment half of an orbit, it may consist of the ascending or descending portion of an orbit (e.g., a descending pass would consist of the ground track segment beginning with the northernmost point of travel through the following southernmost point of travel), or the segment above or below the equator (e.g., either the northern or southern hemisphere portion of the ground track on any orbit). |
| product | Specifically, the Data Product or the EOS Data Product. This is implicitly the labeled data product or the data product as produced by software on the SDPS or SCF. A GLAS data product refers to the data file or record collection either prefaced with a product label or standard formatted data label or linked to a product label or standard formatted data label file. Loosely used, it may indicate a single pass file aggregation, or the entire set of product files contained in a data repository. |
| record | A specific organization or aggregate of data items. It represents the collection of EOS Data Parameters within a given time interval, such as a one-second data record. It is the first level decomposition of a product file. |

| | |
|---|---|
| Standard Data Product | Specifically, a GLAS Standard Data Product. It represents an EOS LASER ALT/GLAS Data Product produced on the EOSDIS SDPS for GLAS data product generation or within the GLAS Science Computing Facility using EOS science community-approved algorithms. It is routinely produced and is intended to be archived in the EOSDIS data repository for EOS user community-wide access and retrieval. |
| variable | Usually a reference in a computer program to a storage location. |